

FREQUENCY OF FOGS.

In the anticyclones, as in the cyclones, the distribution of the frequency of fogs for Davenport seems rather erratic. On the whole, fogs are least frequent in the east half of the anticyclone where the winds are from the north (fig. 32). The area of greatest frequency lies in subareas 2, 3, 8, 9, and 17. It is quite likely that the presence of the Mississippi River affects, to some extent, the frequency of fogs in anticyclones.

FREQUENCY OF CLOUDINESS.

The total number of observations on clouds in anticyclones is, of course, much smaller than the number of observations on clouds in cyclones. As a result of this the figures showing cloudiness in the anticyclones present many irregularities. This is especially true with regard to the higher clouds. The distribution of cloudiness in the anticyclones is clearly the reverse of the distribution of cloudiness in cyclones in the case of the nimbus (fig. 33), the stratus (fig. 36), the alto-stratus (fig. 41), and the cirro-stratus (fig. 44) clouds. This condition is less

evident in case of the alto-cumulus (fig. 40) and the cirrus (fig. 45) clouds, and it can not be said to be at all noticeable in the chart for the cumulus clouds (fig. 37). Averages based on a larger number of observations must be expected to change some of these charts.

CONCLUSION.

In this paper, the author has limited himself mostly to statements of facts supplementary to the illustrations. This was done in the belief that a fuller discussion of the elements of the weather, in any single locality, can best be made after other studies, like these, shall have been worked out for other places, representing several climatic regions in our country. Such studies would enable us to make comparisons from which we could infer, with greater confidence than we can do now, the causes of distribution of weather elements. With the wealth of material at hand for such studies, there can hardly be any doubt but that tabulations like those presented here will sooner or later be made on a basis that will render such comparative studies productive of important results.

BRAZILIAN METEOROLOGICAL SERVICE (1921-1923.)

By J. DE SAMPAIO FERRAZ, Director.

[Directoria de Meteorologia, Rio de Janeiro, February 16, 1923.]

Deeming it of some interest to other meteorological organizations of the world, we have prepared for their benefit a short resumé of the work done in the last 20 months by the new Brazilian Meteorological Service, created in June, 1921. As explained in our Foreign Circular No. 1 of that year, the meteorological activities in Brazil always depended on other bureaus, and before 1921 it was often simply a department of astronomical organizations. While the program was limited to pure climatological work, there was not much harm done in this partnership. But with the development of the net of stations and the possibility of their being utilized in other departments of general meteorology, and moreover with the progress of atmospheric science, rapidly creating new services, the old arrangement was certainly an inconvenience. To make this evident we have indicated in this report the good results brought about by the independence of the meteorological service in Brazil. The contrast will be clearer if we first show what the old service was doing in May, 1921, just before the establishment of the present directoria. Despite the direction of my distinguished predecessor, Dr. Henrique Morize, whose first attempts to classify and investigate Brazilian climatology are well known, the old directoria confined itself strictly to the climatological work. Weather forecasting was under our personal supervision, studied and practiced *intra muros*, with distribution restricted to the capital. The net of stations was greatly augmented by the old organization, but no publications were issued except for the year 1910, which we had printed in Brussels together with our *Instruções Meteorológicas*.

Now, let us point out what the new independent service has done in the last 20 months and is doing at present.

Climatology.—The old service had in May, 1921, 51 stations of second order, 46 of third order, 31 pluviometric, and 26 cooperative. The new bureau has now 74 stations of second order, 78 of third order, 57 pluviometric, and 180 cooperative. Inspection, which was previously

almost nonexistent, is now actively carried out all over the country. Yearly bulletins were put out for 1911, 1912, 1913, 1914, 1915, 1916, 1917, 1918, and a book of normals was issued; 1919 and 1920 are being printed. Before June, 1921, no data were published in newspapers. Now every station is obliged to publish two-weekly reports, and those that are located in capitals of States issue daily summaries of their weather and that of other points of interest to the local population and business.

Weather forecasting.—The new service started distribution of daily forecasts through the southern States, using telegraph and telephone. Forecasting with synoptic charts is only possible in the southern States of Brazil. The service was organized in Rio de Janeiro and São Paulo where every farmer near a railway station, a telephone or a telegraphic office, can receive before 6 o'clock in the evening the official forecasts for the next 24 hours. Santa Catharina and Parana are being prepared to have the same service this year. In the large towns the weather forecasts are distributed by flags.

Several storm warning towers were put up on the southern coast. All the radio stations of the coast, 12 in number, broadcast every 4 hours the weather of the occasion, the wind direction and speed being given by automatically recording instruments. Rio's radio station gives out special bulletins with data of chosen points and the forecasts for weather of night and day. Forecasts are also sent out by radio telephone from Corcovado (Rio).

The Brazilian isobaric charts are constructed from reports of 80 Brazilian stations (from Bahia to Rio Grande), 18 Argentine stations and 6 from Uruguay. On account of the very variable topography of the country and its extensive high plateaus, winds and pressures can only be rightly interpreted with long experience, and in many cases are very troublesome to the forecasters. New processes based on these elements can not be followed in Brazil. Our own empirical rules had

to be discovered and applied. These will be described in a memoir which is being prepared on *Forecasting in Brazil*.

All the above services were started by the new office since June, 1921.

Agricultural meteorology.—Brounov's type of stations were set up for studying wheat, rice, corn, cotton, cane, vines, etc. There are now 8 in working order, and graphs are being made for each one's results. The whole work is carried out as in Russia, years ago, but Azzi's modern views are also considered throughout. The statistical method is being dealt with but we do not expect any appreciable result owing to lack of proper data. A 10-day bulletin is published in all the leading newspapers of the country setting out the conditions of the most important crops, pasture lands, rivers and roads, and how all of them were affected by the weather. Monthly abridged reports are published in magazines. Phenology as practiced in Canada and in England has been started with detailed sheets which are sent regularly every six months from many points of the country. None of these activities existed before June, 1921.

Rain and flood service.—All the rain data is being revised in view of the preparation of a special atlas which will be published this year. The atlas will contain normal deviation charts, normal and "reliability" charts, besides a general discussion of the different zonal dry and wet seasons.

A flood service for the Parahyba River was inaugurated, and the same work is under hand this year for the Amazon where the floods are very destructive to cattle caught unaware by the rising waters. Nothing of this was done by the old service.

Aerology.—Pilot-balloon observations are made at seven stations, including Rio. Two kite stations are being constructed, one in Alegrete (Rio Grande do Sul) and the other in Ceara. The first one will be inaugurated in a couple of months and should reveal interesting data of the secondary circulation in a region which we have

denominated the turntable of moving "highs" and a frequent path of outgoing depressions. The Ceara station is expected to give us an explanation of the curious irregular droughts of northeastern Brazil, which to our mind can only be satisfactorily made clear by revealing unusual conditions of upper currents. Comparative climatology should show us later the origin of these unusual currents, and perhaps lead us to forecast their advent.

Aerology is also assisting aviation in Brazil, and we trust it will help the eminent meteorologists of the world in their search for the missing links of general dynamic theories of the atmosphere.

Aerological work in Brazil is beset with the enormous difficulty of rapid transportation. Hydrogen is only obtainable in Rio, so that pilot-balloon work in distant stations is impracticable until a cheap and convenient process of producing pure hydrogen locally is brought out.

No aerological work of any kind was done by the previous meteorological service.

In conclusion we may point out that meteorological activity in Brazil is surrounded by all kinds of difficulties. Brazil has a very refined and highly intellectual "elite"; but at the back of it exists an enormous mass of people with hardly any primary instruction. All cooperative work with volunteers is yet a dream. Any observer has to be paid and a very persistent action taken to instruct and train him conveniently. Another tremendous difficulty is the size of the country. One can imagine how and why this is so. Appropriations can not ever be sufficient. Considering Brazil is a new country with all kinds of financial and economical problems to solve, we can not expect Congress to exceed a certain budget, proportional to the capacities of the country, although small and modest from the point of view of the meteorologist who confined his thoughts to the development of his beloved science.

PRETECHNICAL METEOROLOGICAL STUDIES.¹

By HOWARD E. SIMPSON.

[University of North Dakota, Grand Forks, N. Dak., December 20, 1922.]

A student contemplating meteorology as a profession has open before him three possible fields. These are (1) the United States Weather Bureau, (2) commercial meteorology, and (3) educational meteorology.

Commercial meteorology is as yet in a very undeveloped stage while educational meteorology, while occasionally given in a department of meteorology and climatology, is generally limited to courses offered in the departments of geology, geography, physics, or astronomy. There appears as yet no good reason for differentiating between the preparation for either of these or from that of the professional work of the Weather Bureau.

The United States Weather Bureau may be entered through civil service examination for (1) assistant observer, or (2) for observer and meteorologist. Only men are eligible for the latter examination.

For the position of assistant observer the examination is extremely elementary; little more than ordinary high-school subjects are required, the salary being insufficient to attract many college graduates.

The requirements include penmanship, English composition, arithmetic, algebra through quadratics, the geography of the United States, elementary physics and

elementary meteorology. Meteorology is the only subject in the list not taught in the elementary public schools or standard high schools. A thorough study of Waldo's *Elementary Meteorology* is considered sufficient preparation for this elementary examination. Appointments to the Weather Bureau above the grade of messenger are made on the basis of an examination in these subjects.

By the more advanced examination it is desired to procure persons who both by education and experience are qualified for the broader work of the Weather Bureau. The examination for the position of observer and meteorologist have not been given for the last three or four years on account of funds not being available for making appointments at the higher salaries attached to these positions. It is hoped, however, that provision may early be made providing for regular promotion with increases of salary in the higher grades. This would enable the Weather Bureau to hold out more promising prospects to young men from the colleges and universities who may desire to follow meteorology as a profession.

The college subjects required for the higher examination are mathematics, including geometry, trigonometry, analytics, calculus, and the theory of statistics, physics,

¹ Read by title at Cambridge meeting of American Meteorological Society, Dec. 29, 1922.